

## Measurement of Lake Level Variation Using Satellite Altimetry

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Although satellite radar altimeters are designed for measuring sea level over the open ocean, an altimeter **will** establish lock and track over moderate-sized lakes. Temporal changes in the **altimeter-derived** lake levels are actually a combination of real lake-level variation and altimeter error.

Collinear analysis of altimeter data over short groundtracks, such as lakes, present different problems than those encountered when analyzing ocean data. We have developed a technique to overcome these difficulties, which, for each pass over a lake, returns accurate estimates of the temporal lake level/altimeter error variation.

As a demonstration, we have applied this technique to data collected over the Great Lakes by **Geosat** (1 1/86 - 11/88; 17-day repeat cycle) and **Topex/Poseidon** (9/92 - 7/93; 10-day repeat cycle). Lake levels, obtained from the Great Lakes Division, NOAA/National Ocean Service, were used as ground truth. The **Geosat** results, based on the **TEG-2B** orbit, have an RMS error of 11.1 centimeters with distinct trends in the residuals which obscured some lake level fluctuations. **Topex/Poseidon** provides a substantial improvement with an RMS error of about five centimeters with no significant trends in the residuals. Not only is the annual cycle of the lakes accurately measured, subtle changes in lake level are also detected.

A preliminary survey indicates that **Topex/Poseidon** is in lock over more than 45 inland bodies of water. This suggests that this satellite could provide a significant database for hydrological research.

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